Science and Technology in the New Alberta Economy

Toward 2000 Together

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A Discussion Paper
Issued By Alberta
Technology,
Research and
Telecommunications

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Science and Technology in the New Alberta Economy has been prepared by the Department of Technology, Research and Telecommunications as a complementary discussion paper to *Toward 2000 Together*, issued in August 1991, by the Government of Alberta.

Toward 2000 Together opens the discussion of possible economic development and diversification strategies for Alberta which will prepare our province to meet the challenges of this decade and beyond. It outlines the various options and choices available to the Government across all industries and sectors.

Science and Technology in the New Alberta Economy more precisely focuses on the science and technology development issues facing Alberta and the options and choices available to the Government in this critical area. It should be read in conjunction with *Toward 2000 Together*.

To obtain a copy of *Toward 2000 Together*, or for more information on this Government-wide initiative, please call (toll free) 1-800-661-PLAN. For more information on *Science and Technology in the New Alberta Economy* or the Department of Technology, Research and Telecommunications, please call the Department's Corporate and Public Relations Division in Edmonton at (403) 422-0567.

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Table of Contents

An Introduction by the Minister 1

Setting the Context – Canada and The Emerging Global Economy 2

Historical Perspective 2

The Erosion of Commodity Prices 3

Declining Productivity 4

Technological Deficits 5

Availability of Suitably Trained Human Resources 6

A Questionable Commitment to Science and Technology 7

The Challenge – Transforming to a Technology and Knowledge-Led Economy 8

Science and Technology in Alberta – An Historical Perspective 9

Technology and Agriculture 9

Technology and Energy Resources 10

Technology and Forestry 10

Technology and Value-Added Products 10

Technology and New Industrial Clusters 11

Alberta Government Involvement in Science and Technology 12

Science and Technology Issues in Alberta 15

Research and Development 16

Human Resources 17

Technology Adoption and Application 18

Securing Capital 20

Collaborative Efforts 22

Management and Marketing Skills 23

Targeting 24

Is Technology Development Different? 25

Other challenges? 26

Preparing a Submission to Toward 2000 Together 27

List of Figures

Figure 1. Per Capita GDP (at 1985 prices and exchange rates), by Country, 1989 2

Figure 2. All-commodity Price Index (Inflation-adjusted) 3

Figure 3. Growth of Labour Productivity in Manufacturing (1979-1989) 4

Figure 4. Technological Balance of Payments, Canada, 1979-1987 5

Figure 5. Researchers, Scientists and Engineers per 10,000 Total Labour Force 6

Figure 6. Gross Expenditures on Research and Development as Percentage of GDP 7

Figure 7. Circles of Development 8

Figure 8. Per Capita Gross Domestic Product, by Province, 1990 9

Figure 9. Per Capita Public Expenditures on Higher Education, by Province, 1987 17

Figure 10. Effectiveness of In-Company Training 18

Figure 11. Use of at Least One of the 22 Technologies by Province, 1989 19

Figure 12. Cost of Capital: Country Comparison 20

An Introduction by the Minister

On August 29, 1991, Premier Don Getty released a discussion paper entitled *Toward 2000 Together*. The release of the discussion paper was the beginning of a comprehensive public consultation process to gather the views and opinions of Albertans on the economic options and choices available to our province as we approach the 21st century.

Alberta Technology, Research and Telecommunications is an active participant in the *Toward 2000 Together* process. We believe it is important that Albertans have an opportunity to help shape our Government's economic development and diversification strategies. We are committed to acting on the results of this process by introducing policies and programs in accordance with the best overall economic options for Alberta.

To anyone reading *Toward 2000 Together*, one conclusion seems inescapable: the future economic well-being of Alberta is directly linked to the province's ability to develop and utilize advanced technologies. Only through advanced technologies will Alberta's businesses be able to prosper in a highly-competitive global economy.

Because the development and application of new technologies is so central a theme in *Toward 2000 Together*, I believe it is critical that individuals, businesses and organizations with a particular interest in science and advanced technology play a full role in the *Toward 2000 Together* process. Your informed opinions based on your experiences are crucial to effective decision-making by our Government. This discussion paper, *Science and Technology in the New Alberta Economy*, has been prepared by my Department as a complementary paper to *Toward 2000 Together*. Its purpose is to stimulate discussion regarding the issues and choices facing Alberta in science and technology development.

Please take the time to get involved. The issues are too important to be ignored!

Honourable Fred A. Stewart
Minister
Technology, Research and Telecommunications

"As we move toward the next century, tremendous changes are sweeping across the world of business:

- *Intellectual competition*
- *Sustainable development*
- *Trade liberalization*
- *Industrial rationalization*
- *Technological innovation*

These expressions are not merely buzzwords. They reflect the new realities of doing business in today's extremely competitive global marketplace. The world is changing – and so must Alberta!"

Premier Don Getty
Announcing
Toward 2000 Together

Historical Perspective

By most economic measurements, Canada is a wealthy and economically prosperous nation. In less than a century and a quarter of existence, Canada has achieved one of the world's highest standards of living. Per capita income in Canada is among the highest of the nations comprising the Organization for Economic Co-operation and Development (OECD)(see Figure 1). As well, Canada enjoys an enviable status as a member of the "G7" – the seven most advanced economic powers in the world.

This economic wealth and prestige has been built largely through the extraction and export of Canada's abundant natural resources and commodity products. Minerals, petroleum, forest products, agricultural commodities and fisheries have provided Canada with raw materials and basic products for domestic and international markets. The wealth generated by natural resource industries, in turn, has paid for the importation of needed products and technologies; has allowed service and support industries to establish; and has paid for social programs that are the envy of the world.

In achieving this position, Canada historically has profited from proximity to the huge United States market and the absence of significant competition for its resource and commodity products in other international markets. At the same time, tariffs and trade restrictions shielded Canadian manufacturing firms from significant international competition.

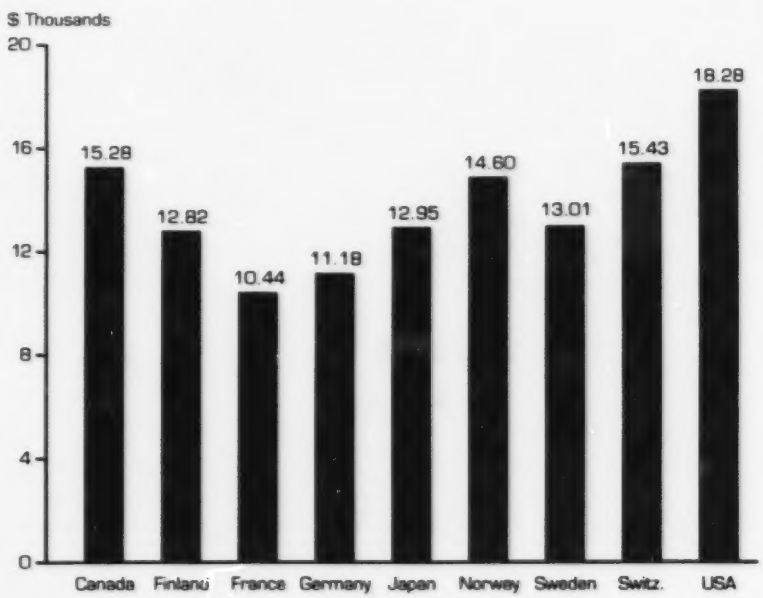


Figure 1. Per Capita GDP (at 1985 prices and exchange rates), by Country, 1989

Source: Main Economic Indicators, OECD

While Canada's economic performance in the past has been strong, there are growing signs that our economic prosperity is at risk. The historical model of relying on resource extraction and commodity exports for growth and development may no longer be relevant.

This is evidenced by the following factors:

- The Erosion of Commodity Prices
- Declining Productivity
- Technological Deficits
- Availability of Suitably Trained Human Resources
- A Questionable Commitment to Science and Technology

The Erosion of Commodity Prices

Canada's commodity exports are facing declining demand and growing competition in world markets often from nations where the cost of production is lower. The result has been a gradual erosion of the value of Canada's commodities over the past 15 years, which shows no signs of reversing in the long-term (see Figure 2).

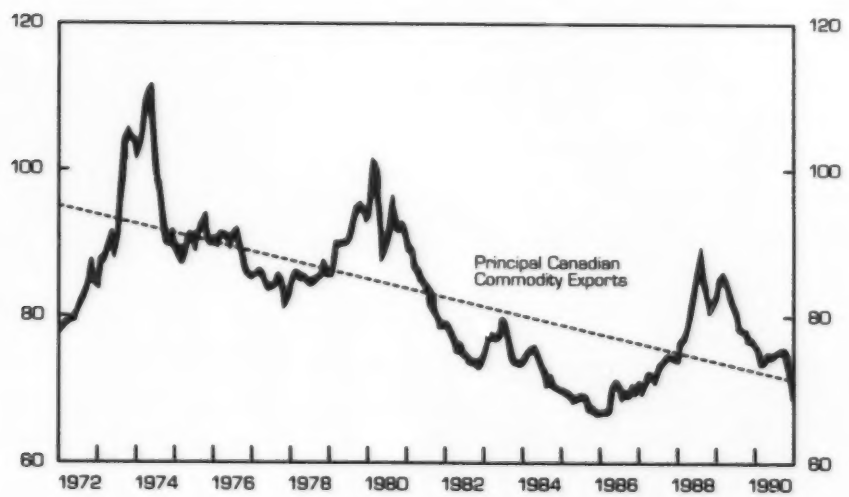


Figure 2. All-commodity Price Index (Inflation-adjusted) Index: 1974=100

Source: Scotiabank Commodity Price Index.

"To achieve sustained productivity growth, an economy must continually ***upgrade*** *itself. An upgrading economy is one that relentlessly pursues greater productivity in existing industries by improving products, utilizing more efficient production processes, and migrating into more sophisticated and higher value industry segments. It is also an economy that has the capability to compete in entirely new industries, absorbing the resources made available from improved productivity in existing industries."*

Professor Michael E. Porter, Harvard Business School, "Canada at the Crossroads", 1991

Declining Productivity

For Canadian industries and firms to survive and prosper in the new global economy, they must be competitive. And in order to be competitive, Canadian industries must become more productive.

Yet Canada's performance in improving productivity and competitiveness is worrisome. Canada's manufacturing productivity growth was the lowest of the G7 nations between 1979 and 1989. It was only 40% of the productivity growth achieved in the United States, which itself lagged well behind most other international competitors (see Figure 3).

While evidence of this nature is typically presented in terms of "labour productivity," it is important to recognize that industrial productivity is shaped by a number of factors, including capital investment, technology adoption, and management practices.

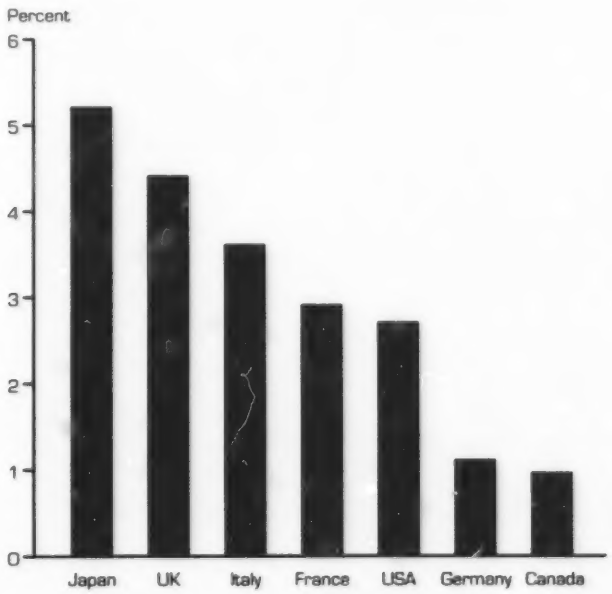


Figure 3. Growth of Labour Productivity in Manufacturing (1979-1989) (average annual rate of change in output per hour)

Source: U.S. Bureau of Labour Statistics, *News*, July 27, 1990.

Technological Deficits

Technology development is essential to improving the productivity and competitiveness of existing industries, and to developing more sophisticated and higher value-added industry segments.

Unfortunately, Canada's record in developing new technologies is a source of concern. The country's technological balance of payments (or the difference between the value of technological imports from other countries and exports from Canada) exhibits a persistent and growing deficit suggesting an increasing reliance on foreign technology development (see Figure 4). It is also indicative of a decreasing ability of the nation as a whole to compete in international technology markets.

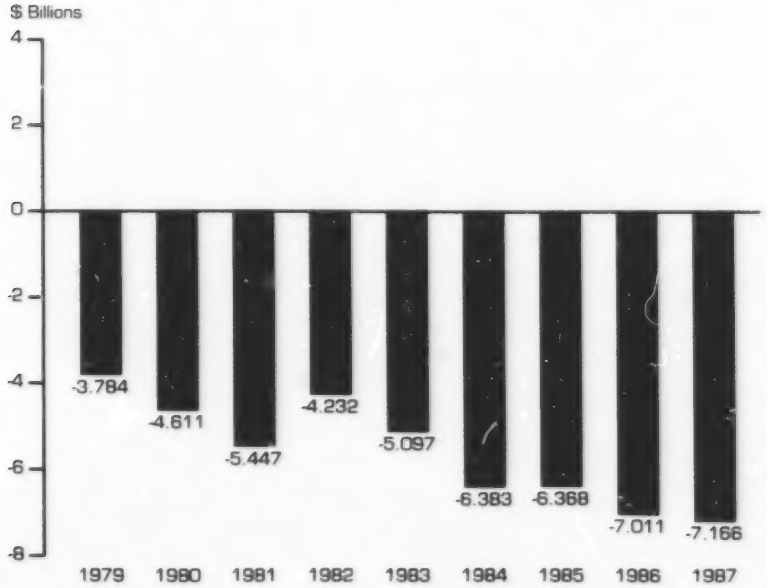


Figure 4. Technological Balance of Payments, Canada, 1979-1987

Source: Statistics Canada

Availability of Suitably Trained Human Resources

A large base of scientists and engineers is required for a nation to develop new technologies at the same rate as international competitors (see Figure 5). Canada, though, continues to graduate fewer scientists and engineers than its international competitors, and enrolments in the natural sciences and engineering have declined in recent years.

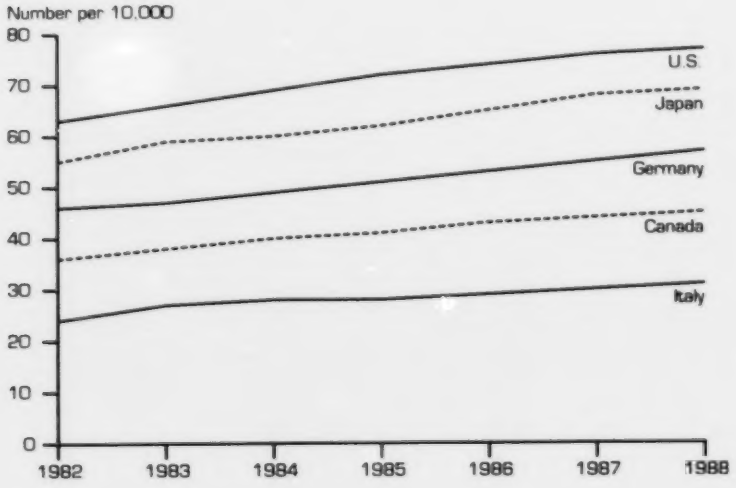


Figure 5. Researchers, Scientists and Engineers per 10,000 Total Labour Force

Source: Porter, "Canada at the Crossroads", 1989 Graph 8 OED

A Questionable Commitment to Science and Technology

Technology development requires a significant investment in research and development. Canada's expenditures on research and development are less than half of most of its trading partners. To many people, this is a source of major concern (see Figure 6).

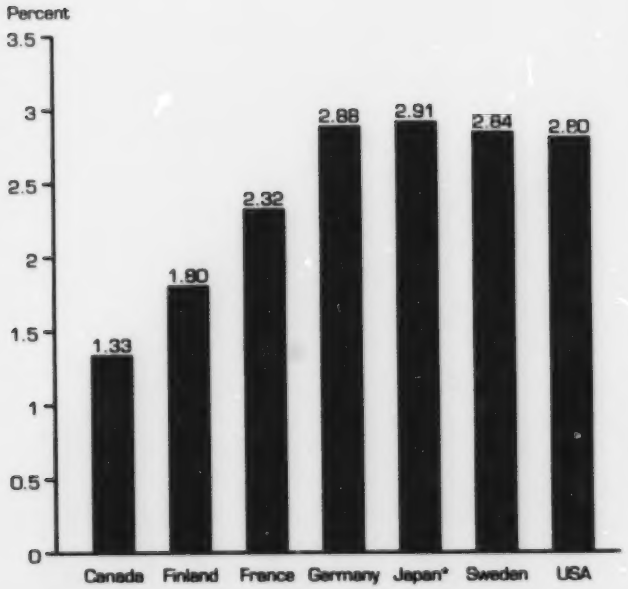


Figure 6. Gross Expenditures on Research and Development as Percentage of GDP

Source: OECD, STIO data bank, Oct. 1990

*Note: The 2.91 figure for Japan represents a 1988 figure since the 1989 figure is N/A.

"We believe that a new vision for the Canadian economy is needed, one in which Canada's natural resource abundance is fully exploited, in which firms and governments focus on creating advanced skills and technology, in which sophisticated home demand drives more firms to create advanced products and processes, in which many more Canadian firms compete globally, and in which competition provides a key stimulus for continual upgrading."

Professor Michael E. Porter, Harvard Business School, "Canada at the Crossroads", 1991

"Canadians will not succeed in meeting international competition, and will therefore face a declining relative standard of living, unless we become much more adept in applying science-based technology to create a continuous flow of innovation and productivity growth. There is no more serious challenge facing Canada today."

Peter J. Nicholson, Chairman, Committee on National Science & Technology Priorities, 1991

Transforming to a Technology and Knowledge-Led Economy

As a result of these factors, Canada is not as advanced as many other countries in the transformation to a "technology and knowledge-led economy" in which continual innovation results in new, more sophisticated industrial sectors and productivity growth. In short, Canada continues to rely on the export of raw materials and basic products while global competitors diversify (see Figure 7).

To expand our industrial base to include more sophisticated and value-added products, as well as to become more competitive in existing industrial sectors, most experts believe that Canada must place greater emphasis on science and technology as the foundation on which our future prosperity depends.

Figure 7. Circles of Development

- The industrial revolution produced the C-circle economy, which was largely preoccupied with processing commodities – turning cotton into textiles, iron ore into pig iron, coal into coke and coke and pig iron into steel.
- Around 1920, it was superseded by the M-circle economy of mass markets, mass production, and manufacturing. Consumers reigned and companies scrambled to supply the houses, autos, and retail goods that kept them happy. C-circle companies that failed to keep the pace – the buggy-whip maker is the perennial metaphor – vanished. Others survived by producing things the M-circle wanted: som buggy-whip makers turned to auto parts an accessories.
- About 10 years ago, the T-circle economy began to take over. Today's fastest growing companies are in industries driven by innovation and technology. The wealth they create comes from the brains of their employees – their knowledge and their ability to do things better.

Source: Nuala Beck and Associates Inc.

T Circle
Technology and knowledge drive world economy.
M Circle
Manufacturing, mass production and consumption drive economy.
Period: About 1919 to the 1980s
Key power: United States
Period: 1980s -
Key power: Japan? or a Confederation of trade blocs?

At the present time, Alberta enjoys the status of a "have" province – one of only three jurisdictions in Canada with a relatively strong economy. In 1990, Alberta's per capita Gross Domestic Product was the highest in the country (see Figure 8).

Alberta, even more so than many areas of Canada, has prospered from the development of its natural resources and agricultural commodities. But also more than many areas of Canada, Alberta faces the challenges of declining prices for its commodities and resources; increasing global competition; and, therefore, the need for greater development and application of science and technology.

In fact, many Albertans are unaware that the effective application of science and new technologies were in large measure responsible for making past development possible and for fuelling many of the successful diversification initiatives of the past decade or more.

Technology and Agriculture

For example, it would be difficult to travel to most parts of Alberta without seeing that it has good agricultural soil. Yet, our short growing season, severe winters, recurring drought and distances from major international markets for agricultural products were significant barriers to development. These constraints were largely overcome through the development and application of new technologies. New crop varieties have been continually developed and introduced in Alberta to accommodate a short growing season and severe weather, while research and development of new transportation methods and systems has helped move the product to market.

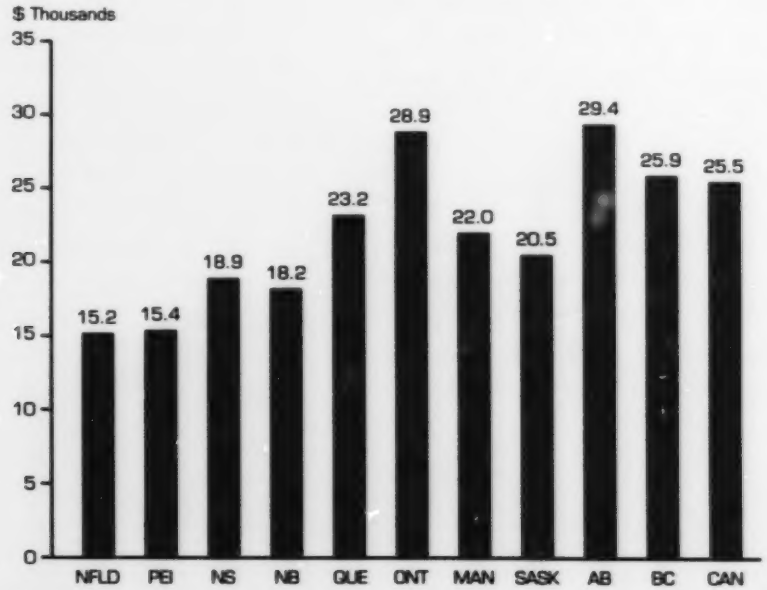


Figure 8. Per Capita Gross Domestic Product, by Province, 1990

Source: Alberta Statistical Review

Technology and Energy Resources

Alberta has abundant petroleum resources. Yet, 95% of these resources are in the form of tar sands and heavy oil – heavy immobile bitumen which will not flow to production wells and which contain high levels of sulphur. World leading recovery and upgrading technology was developed and applied in Alberta to overcome these problems, resulting in the development of an otherwise "worthless" resource. It is quite rightly said that Fort McMurray, centre of Alberta's oil sands plants, is a city built on technology.

As well, advanced petroleum prospecting techniques developed in Alberta have been responsible for the discovery of many of Alberta's conventional petroleum resources, while advanced recovery methods have resulted in much greater efficiency in recovering the petroleum from reservoirs.

Much of the natural gas in Alberta is in small, hard to locate deposits, and many deposits are contaminated with high levels of hydrogen sulphide. Sophisticated exploration and processing techniques are required to convert these resources to saleable commodities.

Alberta's coal deposits are larger than its oil sands deposits and represent an important and continuing source of energy. Although these coals are low in sulphur, they contain high levels of moisture and mineral fines which reduce their commercial value. Advanced treatment and processing technologies have overcome these disadvantages and opened new markets for Alberta coal.

Technology and Forestry

More than half of Alberta has forest cover. Half of this forest cover, in turn, consists of Aspen, which was considered a worthless "weed" species until the mid-1980s, when technological advances demonstrated the commercial usefulness of Aspen. Technology was also applied to overcome the problems of poor drainage and explosive forest fire conditions, thus helping to make development of Alberta's forests possible.

Technology and Value-Added Products

Science and advanced technologies have also played a pivotal role in Alberta's efforts to "add value" to its basic exports by conducting further processing and manufacturing within the province.

A significant petrochemical and plastics industry has developed in Alberta from the energy sector to

become one of our largest manufacturing industries – with shipments valued at more than $3.5 billion in 1990.

Technology development in Alberta led to the establishment of the world's first oriented strandboard plant, while the application of other technologies has led to a forest products industry which produces pulp, newsprint and medium-density fibreboard. The revenues to Alberta from the forestry industry are now approaching $1.6 billion annually.

Agriculture, too, has utilized technologies and new processes to diversify into value-added products such as butter, canola oil, potato chips and a wide variety of others. Food and beverage manufacturing is Alberta's largest manufacturing sector and the value of processed food shipments was $4.5 billion in 1990 – exceeding the value of primary agricultural production!

Technology and New Industrial Clusters

The continual development of new or advanced technologies has become so important to economic growth throughout the world that a new phenomenon has emerged. Completely new industry sectors have emerged based almost solely on the development of new technologies. Examples include microelectronics, computing and software, telecommunications, biotechnology and advanced industrial materials.

In Alberta, some of these technologies were used in traditional industries to improve manufacturing and processing methods, to reduce costs, and to utilize previously marginal materials. Then, slowly, companies with these new technologies began to seek entirely new markets for their products and technologies. For example, in the mid-1980s what began as a supervisory control system for the oil industry migrated to become a control system for a telecommunications network company.

The growth of Alberta's advanced technology industry has been dramatic. From a handful of such companies in the late 1970s, there were over 1,000 in Alberta in 1990, employing about 50,000 Albertans – a level of employment beginning to rival the petroleum industry! While the majority of these firms are small, they often have global markets and are expanding rapidly. Truly, they represent what "competitiveness" and "continual upgrading" are all about.

Alberta Government Involvement in Science and Technology

"...government can improve or detract from national competitive advantage. The question is not whether government should have a role, but what that role should be... Government policy should be directed to building the skills, research infrastructure, and other inputs on which firms draw. Through regulations, tax legislation, competition policies and policies in other areas, government should seek to fashion an environment that supports upgrading and productivity growth."

Professor Michael E. Porter, Harvard Business School, "*Canada at the Crossroads*", 1991

The successes Alberta has achieved in developing and applying new technologies is due in large measure to our aggressive and entrepreneurial private sector. Yet, much of what has been achieved in science and technology is also a direct result of provincial government policies and programs which have long recognized the importance of science and technology to Alberta's economic well-being.

Among Canadian provinces, Alberta has traditionally provided one of the largest research and development budgets. During the past decade, the Alberta Government has invested an average of $250 million per year[1] in research and development and related scientific activities, equivalent to 0.4% of the Gross Provincial Product (GPP). These monies have funded research projects in fields as diverse as forestry and highway construction, as well as agriculture, petroleum resources, health care, advanced materials, biotechnology, microelectronics and many others.

As early as 1920, the Alberta Government began providing direct support to industry in the development and application of new technologies through the establishment of the Alberta Research Council – the first provincial research organization in Canada. In the 1970s and 1980s, other organizations with research mandates were established, such as the Alberta Oil Sands Technology and Research Authority (AOSTRA), the Alberta Heritage Foundation for Medical Research (AHFMR), the Alberta Environmental Centre, and others. These organizations fund and/or conduct leading edge research in their fields of interest and have attracted world-renowned scientists, engineers and technologists to our province.

Throughout its history, one of Alberta's greatest strengths in both human resource development and research has been its universities which have developed new technologies in their own right and have worked with Alberta industries to help them adopt and apply technologies.

Recognizing the growth potential of Alberta's advanced technology industries, the Government provided support to small technology companies via:

- research parks and incubation centres
- financial support through Alberta Opportunity Company (AOC), VenCap Equities, and directly from Government

[1] By providing infrastructure and operating support to the Universities, the Alberta Government also contibutes significantly to the research performed by universities – this component is not included in the $250 million figure above.

- an aggressive export development program
- financial support for research projects

An extensive infrastructure was also put in place in the mid-1980s to develop technology and transfer it to Alberta companies:

- The Department of Technology, Research and Telecommunications was formed in 1986 with a mandate to further the diversification of Alberta's economy in advanced technology areas.
- The Alberta Research Council expanded its high technology capabilities.
- The Electronics Test Centre was established to enable Alberta companies to test their products locally.
- TRLabs was established in partnership with industry and universities to conduct telecommunications research and product development.
- The Alberta Microelectronic Centre was established with university collaboration to assist small companies to use microelectronics in product research and innovation.
- The Laser Institute links university and industry expertise in lasers to assist small and medium sized businesses.
- The Centre for Frontier Engineering Research was established in co-operation with universities, industry and the federal government to capitalize on Alberta's expertise in cold regions technology and engineering.

Provincial Government policies also encouraged Alberta's universities to take a more active role in utilizing technologies for commercial purposes. With Government support, the universities established technology transfer offices to build bridges to the private sector. Millions of dollars annually are now coming to our universities for industry-led contract research.

And the Alberta Government took direct actions to attract major international technology companies to Alberta. Companies came to Alberta because of direct funding support from government in some cases; federal and provincial procurement policies; Alberta's infrastructure; and the "people" resources in our post secondary and research institutions.

In summary, the model for advanced technology development the Government has put in place involves:

- Extensive research and development investment
- Developing infrastructure to support industrial R and D
- Strengthening technology pathways between universities and business and into Alberta from international sources
- Direct and indirect support for individual company research programs to develop new products
- Providing financial assistance to high potential technology companies
- Attracting international technology companies to Alberta

This direct and indirect Government involvement in science and technology in Alberta has been costly and not without some "failures" of companies and projects which had Government support. In technology development, risks and some failures are inevitable. These risks and failures are balanced by the significant benefits Alberta receives from such activity. It is estimated that the money invested by the province in technology development projects attracts up to 2.5 times as much investment from the private sector itself.

This discussion paper, *Science and Technology in the New Alberta Economy*, is based on the assumption that science and technology is critical to Alberta's future economic well-being. The need for research, development and the adoption of advanced technology also is an underlying theme of *Toward 2000 Together*, which suggests a specific objective for Alberta in this regard:

"To encourage the development and application of science, technology and research to enhance Alberta's domestic and international competitiveness."

The inherent assumption is that Government has a role to play to encourage and support technology development.

- Do Albertans actually agree?
- If so, is the model the Government has put in place to support technology development the right one? How can/should it be changed?
- Is the level of Government support the right one?
- Are the programs/mechanisms appropriate?
- What else could/should be done?

The remainder of this section is intended to encourage Albertans to consider those questions and others in specific areas. Your answers to them and your further thoughts are important to the Government.

Research and Development

Issues

Research is the cornerstone of technology development. While the Government of Alberta's research and development budget is among the most generous in Canada, the total spent on research and development in Alberta by all sources (including government, industry and universities) equalled about 0.9% of our Gross Provincial Product in 1989 – less than the Canadian average of 1.3% and less than half of the 2.5% average of the world's leading economies. Many observers believe that, without a greater commitment to research and development in Alberta, we risk falling behind our international competitors.

Questions

- *Should Alberta be doing more research and development?*
- *If so, who should be funding the research and development? Who should perform it?*
- *Can/should the provincial Government do more to leverage industry R and D?*
  - *Different mechanisms?*
  - *Penalty provisions?*
  - *Tax incentives?*

Issues

To conduct research and to develop new technologies, highly skilled and innovative human resources are required. Alberta has an extensive education system and its expenditures on higher education ranks among the most generous in Canada (see Figure 9). Many industry sources predict severe shortages of scientists, engineers, technologists and other skilled workers by the turn of the century. In part, this may be attributable to the realities of the marketplace, in which scientists and engineers do not earn as much as many other professions.

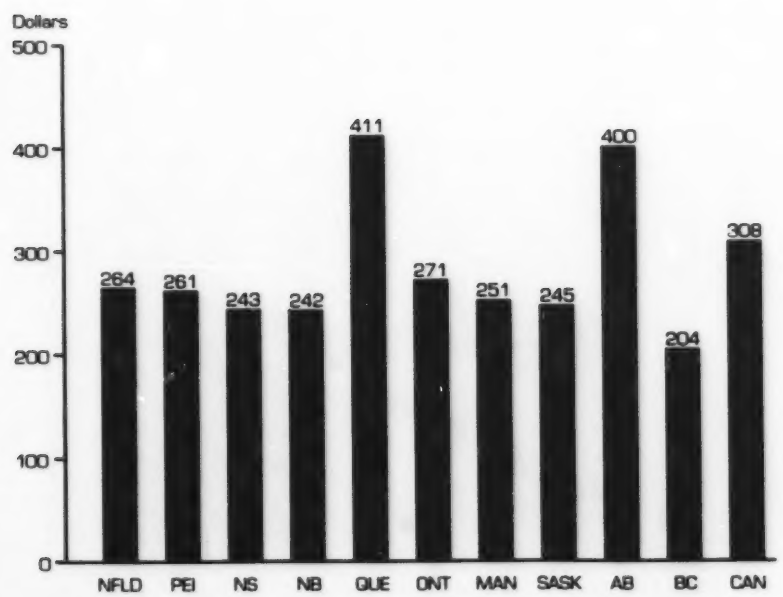


Figure 9. Per Capita Public Expenditures on Higher Education, by Province, 1987

Source: Statistics Canada

Issues (continued)

But adjustments in the public education system would only address part of the problem. Industry in Canada also lags our international competitors in providing effective employer-sponsored training programs (see Figure 10). Without advanced training to improve innovation and productivity, Canadian and Albertan workers are at a serious disadvantage.

Questions

- *Whose responsibility is it (if anyone's) to actively encourage more Albertans to select science and technology careers?*
- *Should potential shortages of skilled workers be accepted as a marketplace reality which will sort itself out with time, or are special incentives needed?*
- *Should the Government encourage more skills upgrading and worker training?*
  - *Restructure funding programs/policies?*
  - *Leverage more private sector spending? How?*
  - *Reorient the educational system?*
  - *Immigration policy?*

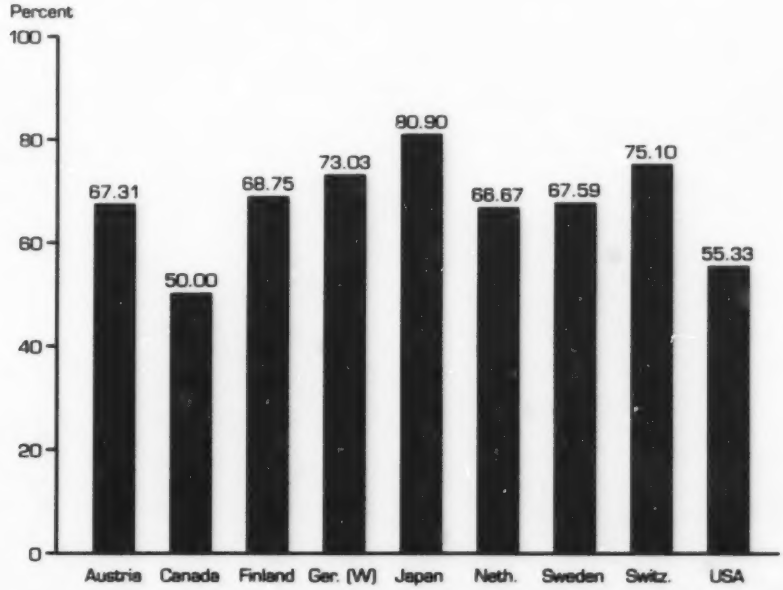


Figure 10. Effectiveness of In-Company Training

Source: The World Competitiveness Report IMD 1991

Issues

In addition to developing our own technologies, they can be acquired from other sources and jurisdictions; adapted for use in Alberta industries; and widely diffused to industry.

A recent survey of Alberta manufacturing firms suggests that local companies are slow to employ state-of-the-art technologies (see Figure 11). Not only does this trend put our companies at a competitive disadvantage, but it denies the province's technology industries a larger, more dynamic local market for their products.

Questions

- *Does the Government have a responsibility to encourage Alberta firms to acquire and adopt new technologies sooner?*
- *How can we develop more "sophisticated buyers" in Alberta?*
  - *Financial incentives?*
  - *Tax incentives?*
  - *Procurement practices and policies?*
  - *Seminars and other information delivery mechanisms?*
  - *Technology exchange experiments with institutions in other countries?*

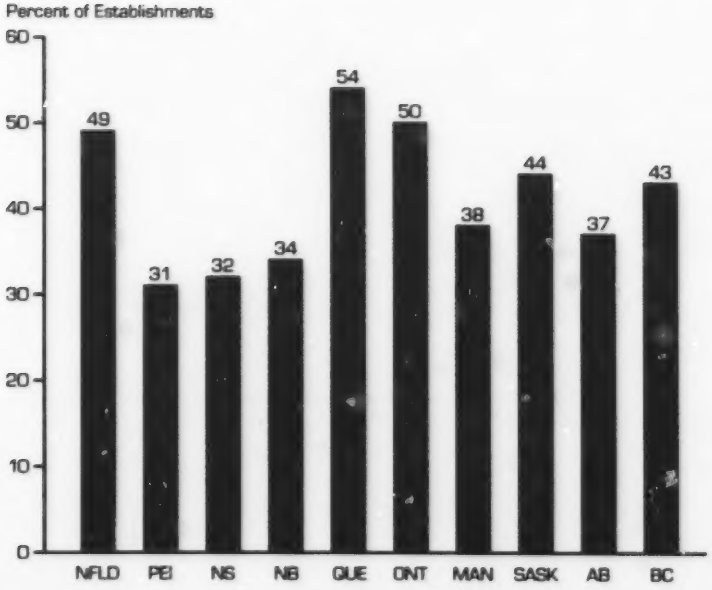


Figure 11. Use of at Least One of 22 Strategic Technologies by Province, 1989

Source: Statistics Canada
Survey of Manufacturing Technologies, 1989

Issues

Financing technology development is another major challenge Alberta firms must face. Recent studies from a variety of sources have indicated that the "cost of capital" in Canada is higher than that of many of our international competitors (see Figure 12).

The result is that Canadian and Albertan firms face higher costs to invest in science and technology development. Small technology-intensive companies, in particular, find it difficult to secure equity financing, loans and joint venture funding. Thus, Canada's most promising sources of competitiveness, innovation and productivity growth are impeded in development.

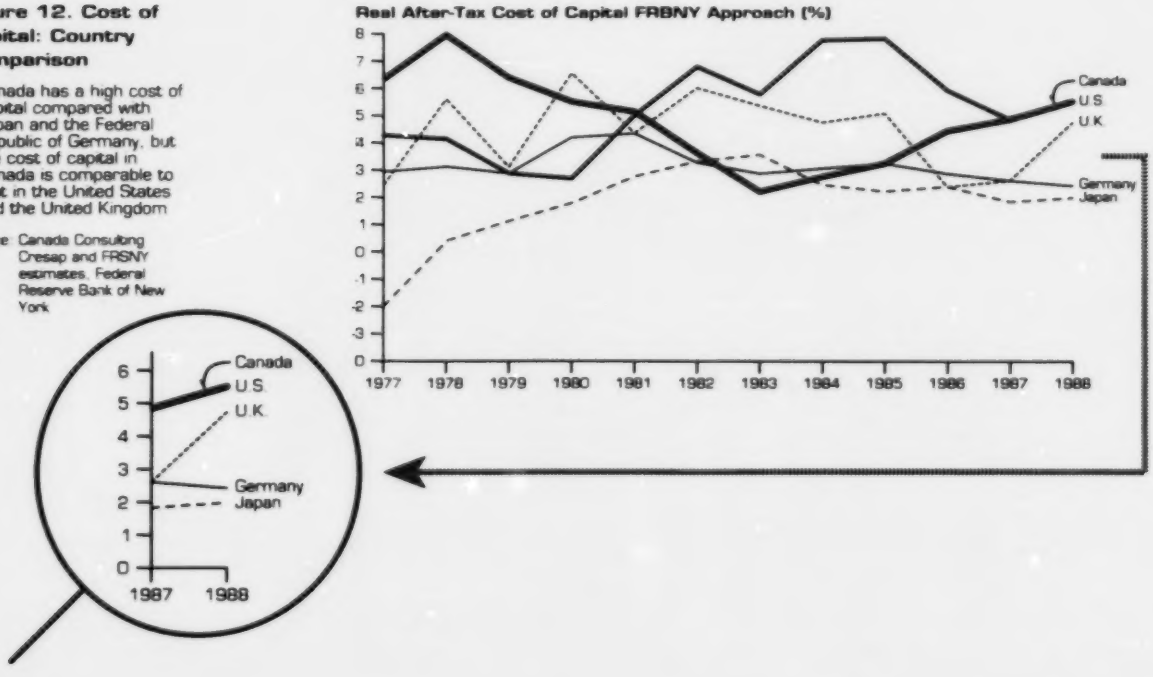
To redress this problem in the past, the Alberta Government established a number of funding mechanisms. Vencap Equities, Alberta Opportunity Company, AltaCan Telecom, and other agencies and programs have mandates to assist high-risk, high-potential, companies through provision of financial assistance. These agencies also have a mandate to provide "smart capital", that is, funding sources which also offer management, marketing and mentoring assistance.

When combined with direct Government involvement this has resulted in a high level of overall government financial backing to technology intensive companies. Yet complaints about access to capital persist.

Figure 12. Cost of Capital: Country Comparison

- Canada has a high cost of capital compared with Japan and the Federal Republic of Germany, but the cost of capital in Canada is comparable to that in the United States and the United Kingdom

Source: Canada Consulting Cresap and FRSNY estimates, Federal Reserve Bank of New York



Questions

- *Does Government have a role to ensure that technology-intensive firms in Alberta have easier access to capital?*
  - *Direct intervention?*
  - *Tax incentives?*
  - *Guarantees?*
- *Should the Government act more in a brokering capacity, introducing local firms to sources of capital?*
- *Are the funding mechanisms currently in place adequate and appropriate?*
- *Should Government withdraw from providing financial assistance to such firms entirely, leaving financing strictly to the private sector?*

Collaborative Efforts

Issues

Technology development projects can sometimes be too far-reaching, risky and expensive for any one firm to handle. In some other countries, industry consortia have been formed to tackle technology development problems. Examples include United States efforts in semi-conductor and optical systems research, and the Japanese industrial planning model.

Within Alberta, our universities and industry have sometimes collaborated in research and development efforts. The Centre for Frontier Engineering Research and TRLabs are prominent examples.

Questions

- *Is there a role for Government in forging more industry collaboration?*
  - *Adjust anti-trust/competition laws?*
  - *Financial incentives for collaborative efforts?*
  - *Tax incentives?*
  - *Assisting in Alberta's participation in international collaboration?*
- *Is there more that can be done to improve/enhance the role of universities?*
  - *More university/industry collaboration?*
  - *Increase funding?*
  - *Targeted funding?*
  - *Leverage more private sector funding?*
  - *Increase relevance to industry?*

Issues

Developing new or advanced technologies is important. Equally important is managing the development process and marketing the technologies or products in Alberta and the world.

Alberta's advanced technology industries have consistently cited a lack of appropriate management and marketing skills to help them take their technologies and products to market. Whether through the education system, training programs, or through immigration, Alberta requires more individuals with these crucial skills.

Questions

- *Whose responsibility is it to encourage/provide management and marketing skills?*
- *What is Government's proper role, if any?*
  - *Education system adjustments?*
  - *Study support?*
  - *Trade missions?*
  - *Training incentives?*
  - *Immigration policies?*

Targeting

Issues

On a global scale, Alberta is a relatively small player. Its annual total research and development budget is easily exceeded by some large multi-national companies, let alone other nations.

As a result, the province has tried to avoid spreading its resources too thinly and, instead, has "targeted" what it considers to be strategically important technology streams for greater support. These include biotechnology, microelectronics, advanced industrial materials, telecommunications and information technologies. In some cases, this targeting has led to industry-wide initiatives with Government support and, in other cases, to support for specific companies in one of the targeted technology streams.

Questions

- *Should Government be "targeting" technology streams in this fashion?*
- *Should the Government financially assist high potential companies in priority areas and give them greater support?*
  - *On what conditions?*
  - *To what extent?*
  - *With which means?*

Issues

Most knowledgeable observers suggest that science and technology is critically important to Alberta's future economic well-being. Yet the Government faces other critical issues in a number of areas, such as health care, social services and education. And, of course budgetary restraint is a constant concern for Government leaders.

Questions

- *Should Government funding and programs relating to technology development receive special attention?*
  - *Above normal fiscal restraint?*
  - *Different delivery/administrative structures?*

Issues

These represent some of the more obvious challenges Alberta faces if it is to be successful in maintaining its economic well-being in the future. Undoubtedly there are other issues and challenges which Albertans can identify as we attempt to define new economic development and diversification strategies for this decade and the 21st century.

Questions

- *What are **your** issues?*
- *What are your **answers?***
- *What are your **recommendations?***

The purpose of *Science and Technology in the New Alberta Economy* is to provide a framework for interested individuals, businesses and organizations in Alberta to consider the science and technology issues facing our province and prepare a formal submission to the Government. The submission will be received as part of the *Toward 2000 Together* economic planning initiative.

The Government is receiving submissions now. There are a number of ways to make your opinions heard:

- Complete and return the questionnaire included with the *Toward 2000 Together* materials.
- Prepare a written brief.
- Encourage your business or industry association to prepare and forward a written submission.
- Attend a workshop (or organize one of your own).
- Plan to attend one of the *Toward 2000 Together* Public Forums. For further information or to arrange a time to make a formal presentation, please call:

  1-800-661-PLAN (1-800-661-7526).

  - Friday, February 14, 1992 in Red Deer at the Red Deer Lodge.
  - Thursday and Friday, February 27-28, 1992 in Calgary at the Glenbow Theatre, Calgary Convention Centre.
  - Friday, March 13, 1992 in Grand Prairie at the Trumpeter Motor Inn
  - Thursday and Friday, March 26-27, 1992 in Edmonton at the Hilton Hotel.
- Attend the Alberta Conference on the Economy. The conference will be chaired by Premier Don Getty, the conference will be held in May, 1992. There are 500 delegate positions, approximately 250 will be opened to the public.

All submissions will be fully considered as the Government prepares its economic development and diversification blueprint for the 1990s.

Submissions may be sent directly to:

Hon. Peter Elzinga
Hon. Rick Orman
Economic Planning Committee
Government of Alberta
Room 324, Legislature Building
Edmonton, Alberta T5K 2B6

OR, you can send your submission to:

Alberta Technology, Research and Telecommunications:
12th Floor,
10909 - Jasper Avenue
Edmonton, Alberta T5J 3L9

We will ensure that it is passed on.

For more information on *Toward 2000 Together*, call (toll free) 1-800-661-PLAN. For more information on technology development in Alberta, call the Corporate and Public Relations Division of Alberta Technology, Research and Telecommunications in Edmonton at (403) 422-0567.

TOWARD 2000 TOGETHER